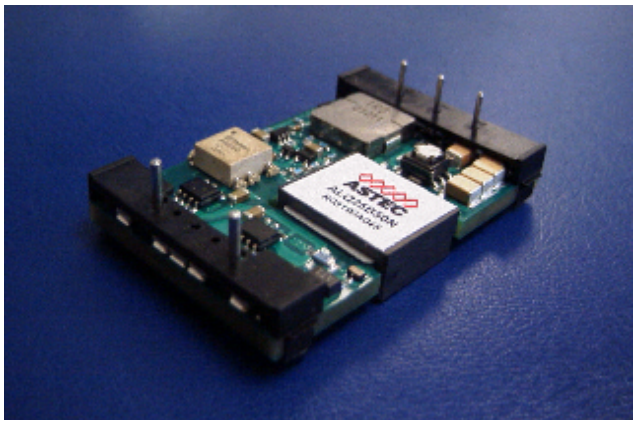
ALQ25B50 Single Output Open-Frame DC Bus Converter
Industry Standard ¼ Brick: 300W DC Transformer

PRELIMINARY

The ALQ25B50 is among a series of Bus Converter solutions from Astec intended to drive multiple non-isolated POLs employed on Distributed Power Architectures (DPA). It's a DC transformer that accepts a narrow input range (48V nominal) to ensure a stepped down output of 12V nominal with 10% line regulation. Such a DC conversion scheme allows the converters to exhibit a purely resistive output characteristic that eases stability management when driving multiple POLs. It comes with ON/OFF Enable pin, Input over voltage and under voltage protection, OTP and output pin length options.



Special Features

- **300W DC Transformer for DPA Front End**
- **Industry Standard ¼ Brick Footprint**
- **High Efficiency**
- **Positive and Negative Enable Options**
- **Regulation to Zero Load**
- **Meets Basic Insulation**
- **Input OVP and UVLO**
- **Low profile / open-frame**

Electrical Parameters

Input

Input Range	**42-53 VDC**
Efficiency	**12V up to 96% Efficiency**
OVP	**60Vdc**

Control

Enable	**TTL compatible**
(Positive and Negative Enable Options)	

Output

Load Current	**0A - 25A max**
Line Regulation	**10.25V – 13.6V**
Load Regulation	**±3%Vo (Typical)**
Ripple and Noise	**80mV (Typical)**

Environmental Specifications

- **-40ºC to 85ºC Operating Temperature**
- **-40ºC to 125ºC Storage Temperature**
- **MTBF > 1 million hours**

Safety

UL + cUL 60950, Recognized
EN60950 through TUV-PS

ALQ25B50 Series

MODEL	CONSTRUCTION	Vin range	Vout/Iout
ALQ25B50	Open Frame; Low profile; Pos Enable; 5mm Pin Length	42V - 53V	12V / 25A
ALQ25B50-6	Open Frame; Low profile; Pos Enable; 3.7mm Pin length	42V - 53V	12V / 25A
ALQ25B50N	Open Frame; Low profile; Neg Enable; 5mm Pin length	42V - 53V	12V / 25A
ALQ25B50N-6	Open Frame; Low profile; Neg Enable; 3.7mm Pin Length	42V - 53V	12V / 25A

OPTIONS:

	SUFFIX
Negative Enable:	"N"
Positive Enable:	No suffix
3.7mm nominal Pin Length	“-6” suffix
5mm nominal Pin Length	No suffix

Electrical Specifications

STANDARD TEST CONDITION on a single module unless otherwise specified.

T_A		25°C (Ambient Air)
Airflow		400LFM
$+V_{IN}$	PIN 1	Connected to +Input
Enable	PIN 2	Dependent on model series
$-V_{IN}$	PIN 3	Connected to -Input
$-V_{OUT}$	PIN 4	Connected to Load return
+ Vout	PIN 5	Connected to Load

ABSOLUTE MAXIMUM RATINGS

Stresses in excess of the absolute maximum ratings can cause permanent damage to the converter. Functional operation of the device is converter is not implied at these or any other conditions in excess of those given in the operational section of the specs. Exposure to absolute maximum ratings for extended period can adversely affect device reliability.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Input Voltage[1]						
Continuous	All	V_{IN}	42	-	56	Vdc
Transient (100ms)	All	$V_{I N, trans}$	-	-	60	Vdc
Isolation Voltage						
Input to Output	All		-	-	2000	Vdc
Operating Ambient Temperature	All	T_A	-40	-	85	ºC
Storage Temperature	All	T_{STG}	-55	-	125	ºC
Operating Humidity	All	-	-	-	85	%
Maximum Enable Voltage	All				5.5	Vdc
Max Output Power[2]	All	P_O	-	-	300	W

Note: 1. The module is not internally fused. Type 3AB Littlefuse rated at 10A, 250V or equivalent is recommended.
2. Output Derating applies. See Figure 9.

Electrical Specifications (*continued)*

INPUT SPECIFICATION

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_{IN}	42	48	53	V_{DC}
Input Under-Voltage Lock-out T_ON Threshold T_OFF Threshold	All		 41 39	 - -	 43 41	Vdc
Input Over Voltage Shutdown Protection[3]	All		-	60	-	Vdc
Maximum Input Current[1] Conditions: V_{IN} =$V_{IN, MIN}$ I_O = $I_{O, MAX}$; T_A = 25 ºC	All	$I_{IN,max}$	-	-	6.6	A
Maximum Input Current I_O = 0A	All				0.17	A
Input Reflected Ripple Current[4] Conditions: P_O = $P_{O, MAX}$; T_A = 25 ºC BW: 5Hz to 20MHz	All	I_{I1}/ I_{I2}	-	5	-	mA_{RMS}

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Set point V_{IN} = $V_{IN, NOM;}$ I_O =$I_{O,MIN}$	All	$V_{O,SET}$	11.85	12.00	12.15	Vdc
Output Regulation Ta=25 ºC Line: V_{IN} = $V_{IN, MIN}$ to $V_{IN, MAX}$ I_O=$_{IO, MIN}$ = 0A	All	-	10.25	-	13.60	Vdc
Load: I_O = $I_{O, MIN}$ to $I_{O, MAX}$ V_{IN}=$V_{IN, NOM}$ = 48V	All	-	-	-	± 5.5	$\%V_O$
Temperature: Ta = 0 ºC to +85 ºC	All	-	-	-	±7.5	$\%V_O$
Ripple and Noise[5] Peak-to-Peak: (5Hz to 20MHz) T_A = 25°C, I_O = $I_{O, MAX}$ V_{IN}=$V_{IN, NOM}$ = 48V	All	-	-	80	130	mVp-p
Other conditions	All	-	-	-	200	mVp-p
Output Current[2]	All	I_O	0	-	25	A
External Load Capacitance Capacitor ESR	All	-	- -	- -	2,000 -	µF mΩ
Output Current-limit Inception[6] V_{OUT} = 90% $V_{O, SET}$	All	I_O	26.5	-	40	A
Over Temperature Range[7] (Average PCM Temperature)	All		110	115	120	°C
Switching Frequency	All	-	780	800	820	KHz

Electrical Specifications (*continued)*

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Efficiency $V_{IN} = V_{IN-MIN}$ to V_{IN-MAX} I_O = 13.5A Resistive load T_A = 25°C	All	η	94	96	-	%
Turn-On Response Time from Active Enable to 90% V_O (T_A = 25°C)	All	-	-	-	4.0	ms
Output Overshoot at T-on / T-off Ta=25°C Passive Resistive Full Load	All	-	-	-	200	mV

Note: 3. The modules will shutdown once the input voltage OVP threshold is attained. Restart is possible once the fault is removed and the input voltage is cycled.
4. See Figure 1 for the Input Reflected Ripple Current test measurement setup.
5. See Figure 2 for the Output Ripple test measurement setup.
6. In an event of an over current condition - the output will be in shutdown mode to prevent excessive heating that could eventually damage the converter. Restart is possible once the input voltage or Enable is cycle for a 10 second wait period.
7. Output of the module will be terminated once the average PCB temp reaches the OTP range. Normal operation resumes once the temperature falls below the OTP range.

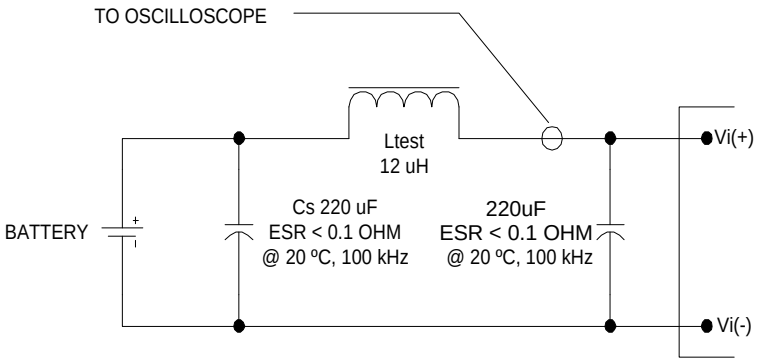
FEATURE SPECIFICATION

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Enable ON/OFF						
Negative Enable ("N" suffix)						
Enable Pin voltage for Module ON	N	-	0	-	0.8	V
Module OFF	suffix	-	2.00	-	5.0	V
Positive Enable (No suffix)						
Enable Pin voltage for Module ON	No	-	2.00	-	5.0	V
Module OFF	suffix	-	0	-	0.8	

SAFETY APPROVAL

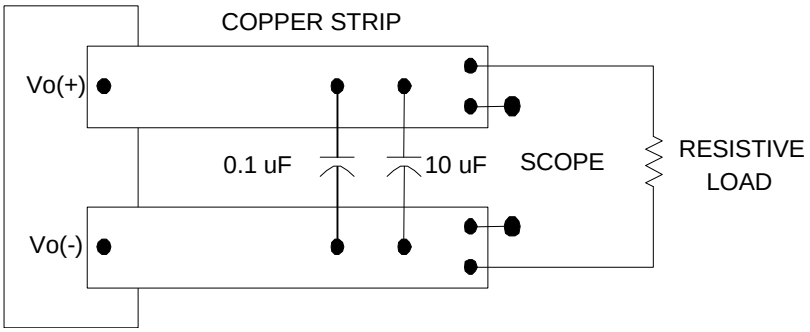
The ALQ25B50 series have been certified through:
- UL + cUL 60950, Third Edition - Recognized
- EN 60950 through TUV-PS
- Basic Insulation
- UL94V-0 flammability rating

Electrical Specifications (*continued)*



Note: Measure the input reflected ripple current with a simulated source inductance (Ltest) of 12uH. Capacitor Cs offsets possible battery/ source impedance. Measure current as shown above.

Figure 1. Input Reflected Ripple Current Measurement Setup.



Note: Use a 0.1µF 50V X7R ceramic capacitor and a 10µF 25V tantalum cap. Scope measurement should be made using a BNC probe socket. Position the load between 51 mm and 76 mm (2 in. and 3 in.) from module the latter.

Figure 2. Peak to Peak Output Noise Measurement Setup.

Basic Operation and Features

INPUT UNDER VOLTAGE LOCKOUT

To prevent any instability to the converter, which may affect the end system, the ALQ25B50 series have been designed to turn-on once V_{IN} is in the voltage range of 41-43 VDC. Likewise, it has also been programmed to turn-off when V_{IN} drops down to 39-41 VDC.

INPUT OVER VOLTAGE PROTECTION

The ALQ25B50 employs a DC Transformer conversion scheme where the input and output relationship is dictated by the turns ratio of the windings. The OVP circuit senses the input line and shuts down the entire module once the sensed voltage reaches the OVP threshold. Restart is possible once the fault is removed and the input power is recycled.

OUTPUT ENABLE

The ALQ25B50 series comes with an Enable pin (PIN 2), which is primarily used to turn ON/OFF the converter. Both a Positive (no part number suffix required) and a Negative (suffix “N” required) Enable Logic options are being offered. Please refer to Table 2 for the Part Numbering Scheme.

For Positive Enable, the converter is turned on when the Enable pin is at logic HIGH or left open. The unit turns off when the Enable pin is at logic LOW or directly connected to $-V_{IN}$. On the other hand, the Negative Enable version turns unit on when the Enable pin is at logic LOW or directly connected to $-V_{IN}$. The unit turns off when the Enable pin is at Logic HIGH.

OVER CURRENT PROTECTION (OCP)

The Over Current Protection circuit comes in latching mode. The converter is latched off if the load current on the output reaches the OCP threshold limit. The OCP latch can be reset either by cycling the input voltage or toggling the Enable signal for 100ms. Consult factory for Auto-restart option.

OVER TEMPERATURE PROTECTION (OTP)

The Over Temperature Protection circuit will shutdown the converter once the average PCB temperature reaches the OTP range. This feature prevents the unit from overheating and consequently going into thermal runaway, which may further damage the converter and the end system. Such overheating may be an effect of operation outside the given power thermal derating conditions. Restart is possible once the temperature of the sensed location drops to less than 110°C.

Performance Curves

Efficiency Curves

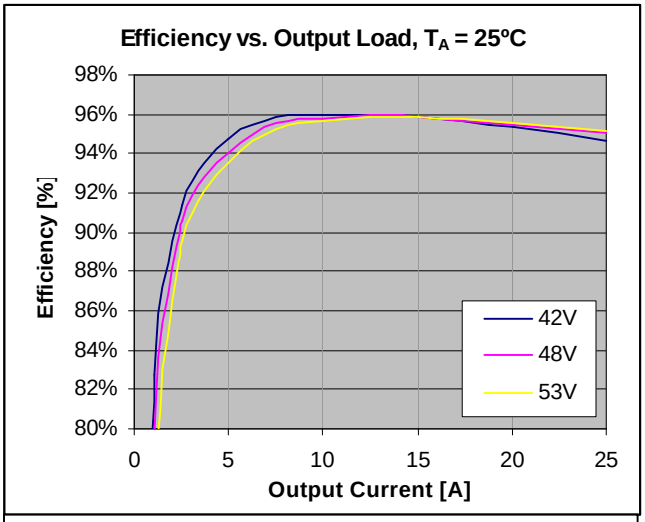


Figure 3. Efficiency vs. Output current at T_A = 25ºC with 400LFM airflow directed across pin 3 to 1.

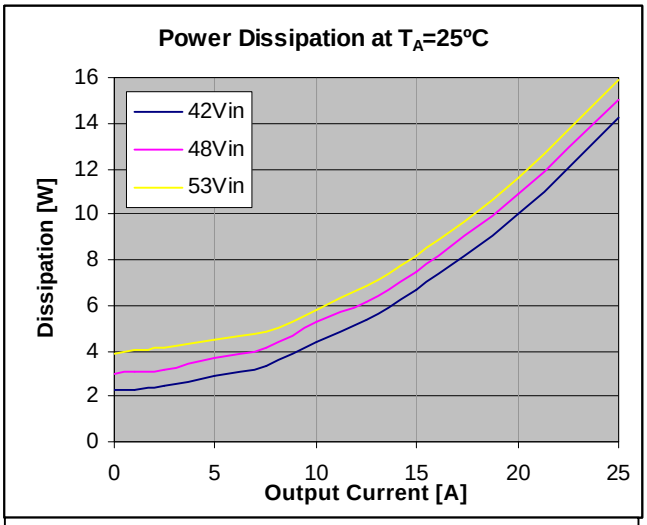


Figure 4. Power dissipation curves at T_A = 25ºC with 400LFM airflow directed across pin 3 to 1.

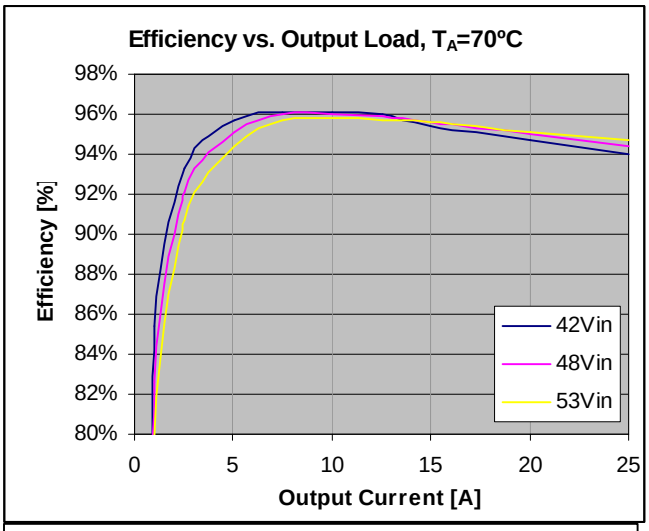


Figure 5. Efficiency vs. Output current at T_A = 70ºC with 400LFM airflow directed across pin 3 to 1.

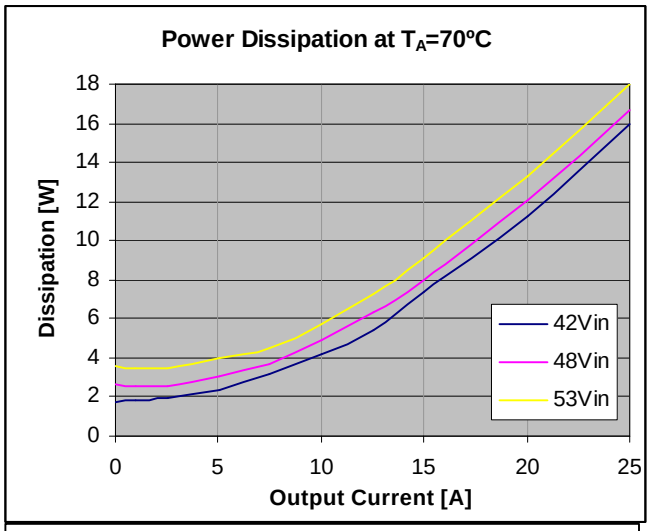


Figure 6. Efficiency vs. Output current at T_A=70ºC with 400LFM airflow directed across pin 3 to 1.

Performance Curves

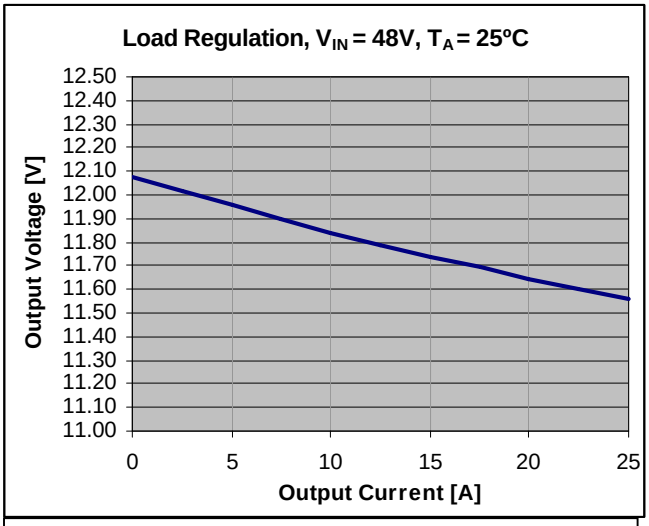


Figure 7. Load Regulation at $V_{IN} = V_{IN, NOM} = 48Vdc$, $T_A = 25ºC$ with 400LFM airflow directed across pin 3 to 1.

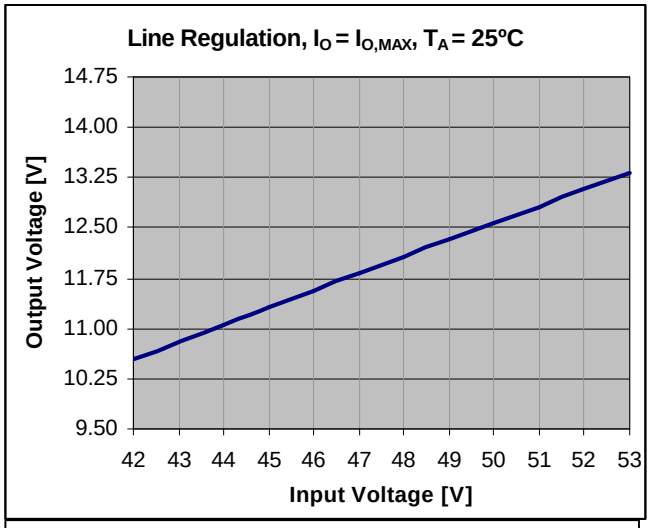


Figure 8. Line Regulation at $I_O = I_{O, MAX} = 25A$, $T_A = 25ºC$ with 400LFM airflow directed across pin 3 to 1.

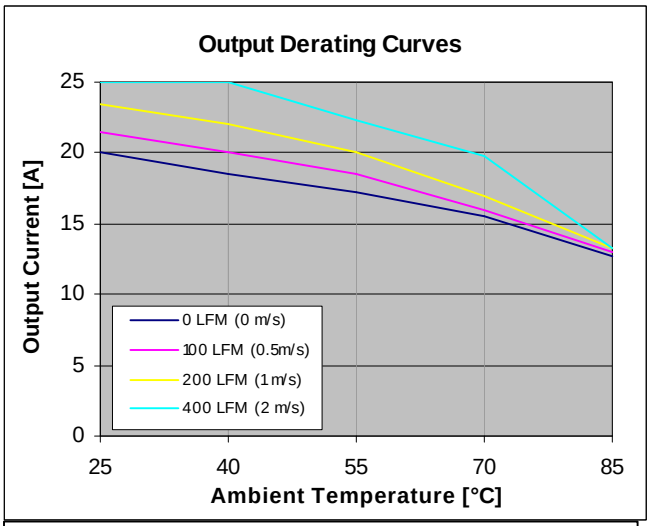


Figure 9. Output Derating curves at V_{IN} = 48Vdc with 400LFM airflow directed across pin 3 to 1.

Mechanical Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Dimension	All	L W H	- - -	2.30 [58.42] 1.45 [36.83] 0.40 [10.16]	- - -	in [mm] in [mm] in [mm]
Weight			-	49.9 [1.76]		gm [oz]
PIN ASSIGNMENT						
1 **2** **3**	**$+V_{IN}$** **ENABLE** **$-V_{IN}$**		**4** **5**	**$-V_O$** **$+V_O$**		

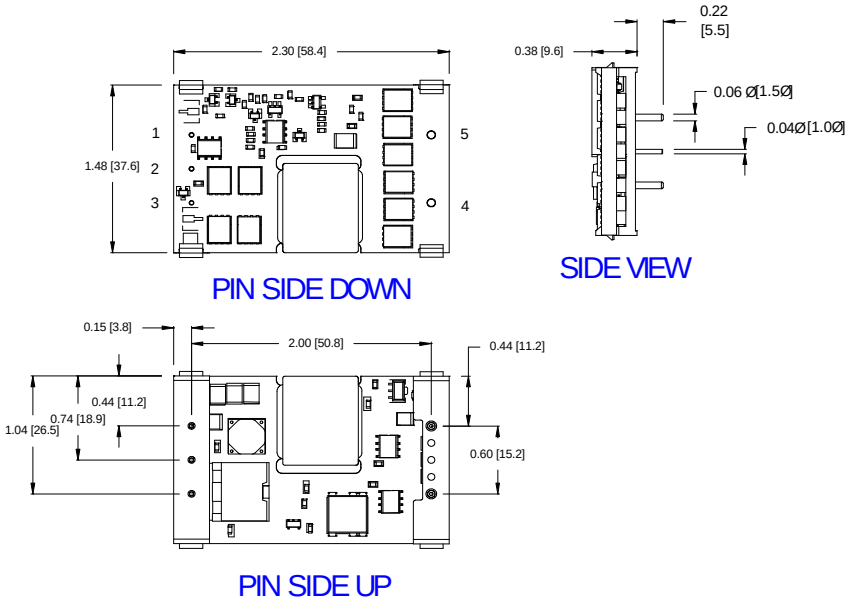


Figure 10. ALQ25B50 Series Mechanical Outline Drawing

Mechanical Specifications *(continued)*

SOLDERING CONSIDERATIONS

The ALQ25B50 series converters are compatible with standard wave soldering techniques. When wave soldering, the converter pins should be preheated for 20-30 seconds at 110°C and wave soldered at 260°C for less than 10 seconds.

When hand soldering, the iron temperature should be maintained at 425°C and applied to the converter pins for less than 5 seconds. Longer exposure can cause internal damage to the converter. Cleaning can be performed with cleaning solvent IPA or with water.

PART NUMBERING SCHEME FOR ORDERING

	OUTPUT VOLTAGE		ENABLE LOGIC
ALQ25	x	50	y
	B = 12V		N = Negative Enable "Blank" = Positive Enable (Default)

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or visit us at www.astecpower.com